communication section for generating a unique global address by the system component node itself upon connection to the network, and for transmitting the generated global address, attribute information of the system component node and installation position information of the system component node, to the network; and

a management node for monitoring and operating the system component nodes through the network and managing control of the whole control system, wherein

the management node includes:

a communication section for performing communication through the network;

a storage section for storing definition information of the system component nodes;

a display section for displaying an operation and monitor screen;

a definition information generation section for generating the definition information based on the global address, the attribute information and the position information which are acquired through the network, and for storing the definition information in the storage section;

a screen generation section for making the display section display the operation and monitor screen of the system component nodes from the definition information in the storage section; and

(6) The control system as described in (1), wherein each of the communication sections of the system component node and the communication section of the management node ~~have~~ has an address generation section for generating a unique global address.

[0027]

(7) The control system as described in (1), wherein each of the communication sections of the system component node and the communication section of the management node performs packet communication.

[0028]

(8) The control system as described in (7), wherein the communication section has an authentication section for adding authentication data to a header of a packet, and determining validity of the received packet according to the authentication data added to the packet.

[0029]

(9) The control system as described in (7), wherein the communication section has a cryptograph processing section for encrypting a packet.

[0030]

(10) The control system as described in (7), wherein the communication section of the system component node multicasts a packet including the generated global address as a source address to all of the management node and the system component

the position where the system component node 40 is installed in the plant. The attribute information determination section ~~52a~~ 52b determines the attribute information of the system component node 40 for validity.

[0062]

The control function providing section 53 reads the control functions from the control function definition DB 51d and outputs the control functions to the communication section Tr. The screen generation section 54 reads the definition information of the operation and monitor screen from the operation and monitor screen definition DB 51e and causes the display section 55 to display the operation and monitor screen.

[0063]

The operation of such an apparatus is as follows:

First, before the plant is controlled, system design for controlling the plant is conducted.

As with the apparatus shown in FIG. 1, the plant designer, developer, etc., designs the numbers, the specifications, the installation locations, etc., of the controllers C(1) to C(3), the sensors SN(1) to SN(4), and the actuators AC(1) to AC(4). Position information for installing the controllers C(1) to C(3), etc., is defined in the system configuration definition DB 51a. The network addresses of the controllers C(1) to C(3), the sensors SN(1) to SN(4), and the actuators AC(1) to AC(4) need not be defined in the network definition DB 51b.

node 40 is added to the network definition DB 51b (SQ8).

[0074]

Further, the control function providing section 53 reads the tag from the tag definition DB ~~41c~~ 51c and reads the control functions from the control function definition DB 51d and outputs them to the communication section Tr. Further, the communication section Tr creates a packet including the tag and the control functions as data, adds authentication data to the header, and encrypts the data. Then, it transmits the packet to the system component node 40 and downloads (SQ9).

[0075]

The system component node 40 of the destination converts the packet received from the management node 50 into plaintext, determines the authentication data for validity, and outputs the control functions included in the packet to the control function acquisition section 43. The control function acquisition section 43 converts into data in an executable format and stores the data in the control function holding section 44 (SQ10). The initial installation at the system constructing time is now complete.

[0076]

The system component node whose installation is complete multicasts a packet including an identifier indicating the normal operation as data to the management node 50 and the relevant system component nodes 40 at regular time intervals.

control result to the communication section Tr. The communication section Tr of the ~~sensor~~ actuator AC generates a packet including the result as data, adds authentication data to the header, encrypts the packet, and transmits the packet to the controller C(1) to C(3) issuing the command.

[0080]

The communication sections Tr of the distributed controllers C(1) to C(3) receive the packets from the communication sections Tr of the various sensors SN(1) to SN(4). Using the received packet data, predetermined control operations, etc., are performed and the actuators AC(1) to AC(4) are operated for controlling the plant. Each of the controllers C(1) to C(3) monitors the upper and lower limit values for input data, output data, etc., and if the upper and lower limit value range is exceeded, each of the controllers C(1) to C(3) converts an alarm signal, etc., indicating the event into a packet and transmits the packet through the network 100 to the management node 50. Further, the various control functions handled by the controllers C(1) to C(3) are sent through the network 100 to the management node 50, which then displays the control functions, the monitor result, etc., of the plant on the display section 55. The operator monitors the display section 55 and again sets the control functions for running and operating the plant in the management node 50 as required and causes the management node 50 to transmit the

For example, if the authentication result of the authentication sensor SN(5) is correct, the controller C(4) opens the electric lock of the door not shown. If the human body sensor SN(6) senses a human being, the controller C(5) turns on the lighting AC(6) and AC(7). Further, the controller C(6) operates the air conditioner AC(8) depending on the temperature from the temperature sensor SN(7). The input/output signals to/from the controllers C(4) to C(6) are transmitted to the management node 50 through the network 100. The data relevant to the items defined in the daily and monthly report definition DB ~~51g~~ 51f and the alarm definition DB 51g is also transmitted to the management node 50 through the network 100. The controllers C(4) to C(6) open/close the electric lock AC(5) and turn on/off the lighting AC(6) and AC(7) and the air conditioner AC(8) according to the schedules in the schedule definition DB. A screen generation section 54 may display an operation and monitor screen, the daily and monthly results, occurring alarms, the current schedule progress situation, etc., on a display section 55 by transmitting and receiving an operation and monitor screen definition DB ~~51f~~ 51e and the input/output signals to/from the controllers C(4) to C(6).

[0106]

Thus, the control system of the invention is applied to the BA, whereby change of the system component node 40 in each

data, so that the validity of the packet can be easily determined at the packet level and the system reliability improves. Further, since the cryptograph processing section Tr3 encrypts a packet for transmission, leak, tampering, etc., of the data in the packet can be prevented.

[0110]

For example, to conduct communications through the Internet, for example, sufficient global addresses would be unable to be assigned with IPv4 (Internet Protocol version 4); this is a problem. Unauthorized access from the Internet also needs to be restricted. Thus, private addresses are assigned to the system component nodes 40 for each plant or for each building. A gateway and a network address translation unit (NAT: Network Address Translation) are provided between the Internet and the system component nodes 40 for enhancing security. Thus, it becomes difficult to externally operate and monitor the system component nodes 40. However, the communication section Tr generates the global address and conducts secure communications in accordance with the IPv6 specifications, so that the gateway and the NAT are not required. Accordingly, the system configuration can be simplified and the cost can be suppressed.

[0111]

Since communications are conducted using the Internet, the management node 50 and the system component nodes ~~50~~ 40

section Tr2 and the cryptograph processing section Tr3 may be uninstalled if the reliability and security of the system component nodes 40 connected to the network 100 are secured.

[0116]

In the apparatus shown in FIGS. 2, 6, and 7, the attribute information determination section 52b for determining the system component nodes 40 for validity is provided, but if ~~an installation mistake and~~ the reliability of the installation of the system component nodes 40 ~~are~~ is secured, the attribute information determination section 52b may be uninstalled.

[0117]

In the apparatus shown in FIGS. 2, 6, and 7, the position detection section 41 performs position determination by GPS using radio waves from an artificial satellite and detects the position, but a plurality of radio wave base stations for emitting radio waves may be installed in a plant or a building and the system component node 40 may receive the radio waves emitted from the radio wave base stations and may detect the position of the home node based on the received radio wave strength. Particularly, the mode is effective in a place that the radio waves from the satellite do not reach or are hard to reach (for example, underground or valley between tall buildings). The position may be detected using ultrasonic waves rather than radio waves.

[0118]

transmitting and receiving the input/output signals to/from the sensors SN(1) to SN(7) and the actuators AC(1) to AC(8) and reflect the control functions on the control function definition DB 51d of the management node 50, so that the need for the operator to find the optimum control function from the operation and monitor screen of the display section 55 and store the optimum control function in the control function definition DB 51d is eliminated. Accordingly, the number of steps taken after the system configuration is changed can be reduced.